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Assembly Committee on Natural Resources

WESLEY CHESBRO
CHAIR

OVERSIGHT HEARING

A REVIEW OF THE DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES' "OIL AND GAS ISSUES ROAD MAP"

Tuesday, August 14, 2012
2:00 p.m. – 4:00 p.m.
State Capitol, Room 447

AGENDA

Opening Remarks

Wesley Chesbro, Chair

Steve Knight, Vice-Chair

Underground Injection Control Program for Class II Wells

David Albright, United States Environmental Protection Agency, Region IX

Oil and Gas Issues Road Map

Division of Oil, Gas, and Geothermal Resources Staff

- **Underground Injection Control Program**
- **Hydraulic Fracturing**
- **Cyclic Steam in Shallow Diatomite**
- **Carbon Dioxide Injections**
- **Waste Gas**
- **Program Implementation Issues**

Public Comment

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Review of the Division of Oil, Gas, and Geothermal Resources' "Oil and Gas Issues Road Map"

1) Background.

On March 28, 2012, the Assembly Budget Subcommittee on Resources and Transportation held a hearing to discuss, among other things, the Governor's budget proposal to increase funding for the Division of Oil, Gas, and Geothermal Resources (DOGGR), which is an agency within the Department of Conservation (DOC). The staff report for the hearing explained that "[n]ew leadership at DOC is currently developing what it has described as a 'roadmap' designed to set new priorities for DOGGR, as well as address various problems such as the current permitting backlog." At the hearing, the Legislative Analyst's Office recommended that when DOGGR's road map is completed, it should be vetted by the legislative policy committees. Assemblyman Wesley Chesbro attended this hearing and expressed his intent, as chair of the Assembly Natural Resources Committee, to hold a DOGGR oversight hearing in the summer.

On May 3, 2012, DOGGR released its "Oil and Gas Issues Road Map" (see "Attachment 1"). In total, there are nine issues identified in the road map, each with a brief background and a list of "considerations." The purpose of the Assembly Natural Resources Committee's August 14, 2012 oversight hearing is to understand these issues and to learn what DOGGR is doing to address them. This memorandum provides some additional background information on these road map issues.

2) Underground Injection Control (UIC) Program (see issue "2" in the road map).

Pursuant the Public Resources Code, DOGGR is responsible for supervising the drilling, operation, maintenance, and abandonment of oil and gas wells in the state so as to prevent, as far as possible, damage to life, health, property, and natural resources, including underground and surface waters suitable for irrigation or domestic purposes. As part of this duty, DOGGR is also required to permit the owners or operators of a well to utilize all suitable methods and practices known to the oil industry for the purpose of increasing the ultimate recovery of underground hydrocarbons.

For wells that inject fluids associated with oil and natural gas production operations (Class II wells), DOGGR's authority stems specifically from the Public Resources Code and the federal Safe Drinking Water Act (SDWA). In part, the SDWA requires the United States Environmental Protection Agency (US EPA) to develop minimum federal requirements for the UIC program, which is designed to control the injection of wastes into "underground sources of drinking water." Under the SDWA, a state may have primary enforcement responsibility if it adopts and implements a UIC program that meets federal requirements. DOGGR received primary enforcement responsibility for Class II wells through an agreement with the US EPA in the early 1980s. DOGGR maintains this responsibility until either it transfers it back to the US EPA or the US EPA determines that the state program is not in compliance with the SDWA.

In the spring of 2010, US EPA undertook a comprehensive review of DOGGR's implementation of the Class II UIC primacy program. The goals of this program evaluation were (1) to review how DOGGR oversees and manages the permitting, drilling, operation, maintenance and plugging/abandonment of Class II wells and (2) to identify program implementation recommendations.

The final report for this review was released in 2011, and as the US EPA's July 18, 2011 transmittal letter to DOGGR (see "Attachment 2") explains, there were several program deficiencies and areas for improvement that were identified in the review. The letter specifically lists the following three deficiencies that "require more immediate attention and resolution."

a) "DOGGR UIC regulations and primacy documents do not clearly require the District Offices to protect [underground sources of drinking water] to the federally-defined standard of 10,000 mg/L total dissolved solids in the permitting, construction, operation, and abandonment of Class II injection wells."

b) In determining the area affected by a project, DOGGR's "area of review" analyses are almost exclusively based on an approach that for some wells "will not adequately capture the full extent of pressure influences from the injection activity."

c) In determining the fracture pressure of the injection zone, most Class II injection wells overseen by DOGGR do not use a particular test that yields a more accurate measurement of fracture pressure.

In the letter, the US EPA requests that DOGGR submit an "action plan" by September 1, 2011 that addresses these three deficiencies as well as other areas for improvement identified in the report. DOGGR has not yet submitted an action plan to the US EPA, which may be due in part to the recent leadership transition at DOGGR and DOC and because resources are being used to address other demanding issues. DOGGR's road map, however, includes a number of "considerations" for the UIC program, one of which is to ensure that it can "address all of the issues raised by the US EPA audit."

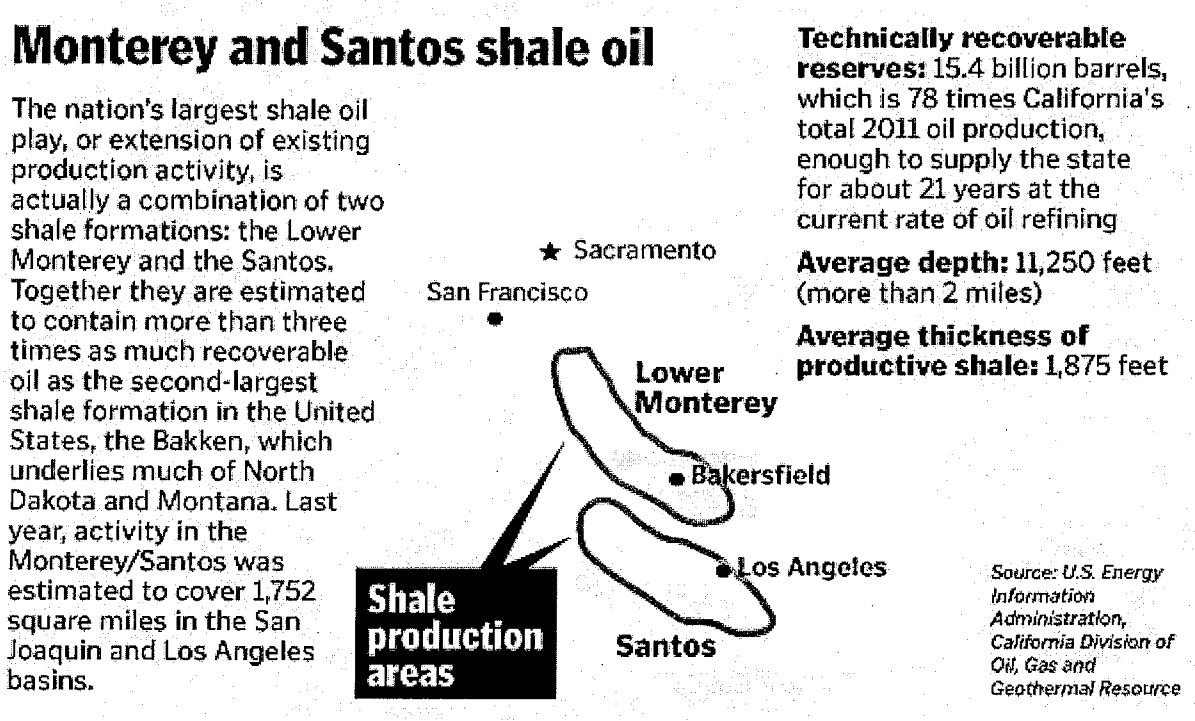
<u>The committee may wish to ask DOGGR how it plans to respond to the US EPA's report and the US EPA's request for an action plan. The committee may also wish to ask the US EPA (1) about the significance of the three deficiencies referenced above, (2) about the necessity of DOGGR submitting an action plan, and (3) if time is of the essence for any of these issues.</u>

3) <u>Hydraulic Fracturing (see issue "1" in the road map).</u>

Hydraulic fracturing is one energy production technique used to obtain oil and natural gas in areas where those energy supplies are trapped in rock and sand formation. Once an oil or natural gas well is drilled and properly lined with steel casing, fluids are pumped down to an isolated portion of the well at pressures high enough to cause cracks in shale formations below the earth's surface. These cracks or fractures allow oil and natural gas to flow more freely. Often, a propping agent such as sand is pumped into the well to keep fractures open.

In many instances, the fluids used in hydraulic fracturing are water-based. There are some formations, however, that are not fractured effectively by water-based fluids because clay or other substances in the rock absorb water. For these formations, complex mixtures with a multitude of chemical additives may be used to thicken or thin the fluids, improve the flow of the fluid, or even kill bacteria that can reduce fracturing performance.

According to a 2008 Society of Petroleum Engineers article[i], hydraulic fracturing "has been applied to a large scale in many Central and Southern California fields to enable economic development and reasonable hydrocarbon recovery." The article further explains that "based on initial experience and formation properties, hydraulic fracturing has a significant potential in many Northern California gas reservoirs." Additionally, many expect a significant increase in hydraulic fracturing in California's Monterey and Santos shale formations, which, according to the US Energy Information Administration, is the largest shale oil formation in the lower 48 states.



JOHN COX and KENT KUEHL / THE CALIFORNIAN[ii]

In California, there is increasing public anxiety related to hydraulic fracturing, which mostly stems from problems in other parts of the country. For example, in Pennsylvania there was a report of tens of thousands of gallons of toxic fracturing fluid that leaked onto residential property, killing trees and contaminating water. The US EPA reported that two water wells in Texas were contaminated by gas from hydraulic fracturing. The investigative news Web site ProPublica, which Congress relies on for information on this subject matter, found over 1,000 reports of water contamination near drilling sites. There are also environmental and public health and safety concerns related to air quality, earthquakes, waste water treatment, and the large amount of water used in the hydraulic fracturing process.

Hydraulic fracturing is specifically excluded from the SDWA, so it is generally up to each individual state to regulate the practice. From May to July this year, DOC and DOGGR hosted a series of workshops (which the Director of DOC has characterized as "listening sessions") to discuss the practice of hydraulic fracturing. The workshops were held in seven different cities (Bakersfield , Ventura, Culver City, Long Beach, Salinas, Santa Maria, and Sacramento), with emphasis placed on holding workshops in population centers in oil and natural gas producing areas. At these workshops, DOC and DOGGR presented information regarding California's geologic formations, well construction requirements, and the technical aspects of hydraulic fracturing (see "Attachment 3"). However, a majority of the time was spent taking public comment.

DOC and DOGGR intend to use input from the workshop series and from an independent scientific study of the practice of hydraulic fracturing to prepare draft regulations. According to DOGGR, the rulemaking process for these regulations will likely begin in the late summer or early fall of 2012.

In addition to these regulation plans, there are currently two hydraulic fracturing bills pending in the Legislature. AB 591 (Wieckowski) will (1) require the owner or operator of an oil and gas well to disclose specific hydraulic fracturing information to DOGGR and the public and (2) require DOGGR to annually prepare a comprehensive report on the use of hydraulic fracturing in California. AB 972 (Butler) will impose a moratorium on hydraulic fracturing until DOGGR adopts regulations governing hydraulic fracturing treatments and those regulations have taken affect. Both bills are in the Senate Appropriations Committee.

<u>The committee may wish to ask DOGGR (1) to summarize the public comment received from the seven workshops, (2) to give a status update on the independent scientific study of the practice of hydraulic fracturing, and (3) to give a status update on the development of the hydraulic fracturing regulations. The committee may also wish to ask the US EPA about the work it is doing with regard to addressing hydraulic fracturing issues.</u>

4) <u>Cyclic Steam in Shallow Diatomite (see issue "3" in the road map).</u>

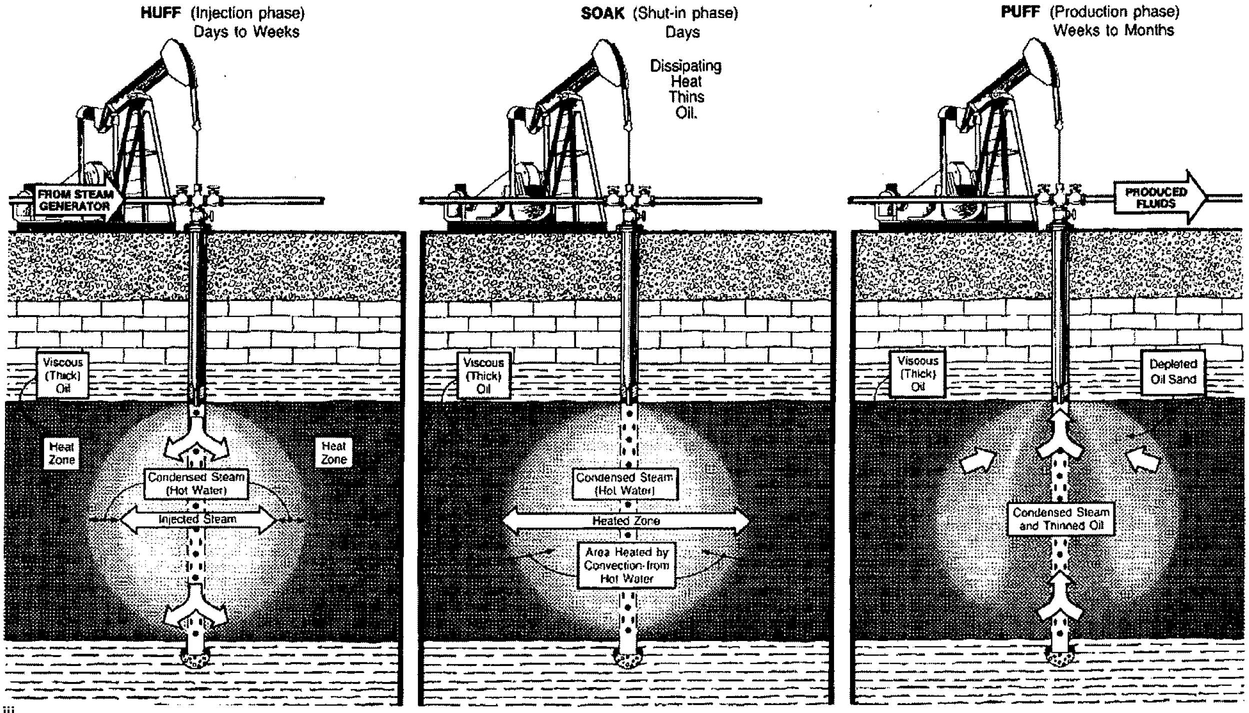
The cyclic steam production process, which has been used since the early 1990s, is a commonly applied method of recovering heavy oil from diatomite formations with low permeability. Kern County, in particular, contains a large number of petroleum reservoirs in shallow diatomite formations.

As depicted in the image below, the cyclic steam process begins when steam is injected at high pressures into the reservoir. The well is then "shut-in" to allow the diatomite to absorb the hot condensed steam and expel the heated, more mobile oil. After the shut-in period, the well is opened up for production. This process can be repeated until production falls below a profitable level.

CYCLIC STEAM STIMULATION

Steam, injected into a well in a heavy-oil reservoir introduces heat that, coupled with alternate "soak" periods, thins the oil allowing it to be produced through the same well. This process may be repeated until production falls below a profitable level.

Schematic portrays one well during the 3 phases of this process. Flow pattern is stylized for clarity.



[iii]

According to a 2005 Society of Petroleum Engineers article[iv], surface breakthrough or eruptions are possible in heavy diatomite in Kern County's Midway Sunset oil field "given the shallow steamflood depth, relatively high injection pressures, and the reservoir's lack of strong continuous shale or barrier rock." A cursory search of the California Emergency Management Agency's Hazardous Material Spill Update database shows that in recent years there have been a number of incidents involving surface expression at diatomite oil fields in Kern County. For example, on December 24, 2011, 445 barrels of "hydrolyzed diatomaceous earth, dirt mixed [with] crude oil" were released "during reactivation of surface expression" in an oil field. On August 17, 2011, "a surface expression occurred due to the injection of steam above the fracture gradient into a shallow diatomite reservoir." During this incident, crude oil and water was expelled 100 feet into the air and steam vapor plumed to approximately 200 feet.

The most notable Kern County surface expression, however, was on June 21, 2011, when tragically an oil field worker fell into a sinkhole and died. According to DOGGR's District 4 dispatch report, "three workers were checking on steam emanating from ground. Ground gave way; one worker tripped feet first into a hidden hole; other workers could not react in time to save him from falling."

On May 2, 2012, DOGGR released a report explaining many of the facts related to the June 21, 2011 fatal sinkhole accident. In a conference call following the release of the report, DOGGR's Supervisor, Tim Kustic, indicated that the agency will be developing regulations to curtail surface expressions (see "Attachment 4"). The interest in new regulations is confirmed in the road map, which states that DOGGR's "rules and regulations for well construction and operation in cyclic steam conditions should be examined to determine if and how they should be modified to reflect the different conditions and forces exerted on production wells and on the subsurface geology."

The committee may wish to ask DOGGR (1) about its plans to develop regulations, (2) when such regulations are expected to go through the rulemaking process, and (3) if it is taking any measures to avoid risks while it plans for regulations.

5) Carbon Dioxide Injections (see issue "4" in the road map).

According to the road map:

> [DOC] is aware of growing interest in using carbon dioxide (CO2) as an enhanced oil recovery (EOR) tool, in combination with [carbon dioxide capture and storage (CCS)] goals. DOC has authority to oversee EOR projects, as reflected in its [UIC] Program. That UIC program has been granted primacy to satisfy [SDWA] requirements for Class II wells. Department expertise in this field is limited because in California water and steam are used far more extensively as EOR injection material than CO2. CO2 does have different properties in a subsurface environment, and [DOC] needs to make sure that any projects involving CO2 injection receive appropriate review by professionals with competency in subsurface CO2 dynamics. The US EPA considers CCS wells to be Class VI wells, over which the [DOC] has no current authority.

SB 1139 (Rubio), which is currently in the Assembly Appropriations Committee, will require the California Air Resources Board (ARB) to develop by January 1, 2016 a quantification methodology for CCS projects that can be used for compliance obligations under the California Global Warming Solutions Act. The methodology must include methods for EOR projects seeking to demonstrate simultaneous sequestration of injected CO2. Upon ARB's adoption of a methodology, DOGGR will be required to regulate these CO2 EOR projects. Since this program involves CO2 injections associated with EOR, it fits within DOGGR's primacy enforcement responsibility for Class II injections.

Under the SDWA, Class VI wells are used for injection of CO2 into underground subsurface rock formations for long-term storage, or geologic sequestration. An example of a Class VI well is a well used by a power plant to inject captured CO2 into the ground for the purpose of reducing emissions into the atmosphere. In contrast to Class II wells, Class VI wells do not have to be associated with oil and natural gas production operations. Class VI wells are also likely to inject more CO2 into formations than Class II wells, resulting in higher pressures. As stated above, DOC and DOGGR currently do not have primary enforcement responsibility over Class VI wells under the SDWA.

The committee may wish to ask DOGGR if it will need additional resources and expertise to regulate CO2 EOR projects if SB 1139 passes. The committee may also wish to ask DOGGR if it is the appropriate state agency to have primacy over Class VI wells.

6) Waste Gas (see issue "5" in the road map).

In the petroleum extraction process, both crude oil and natural gas are often produced from the same well. The natural gas is cleaned to pipeline quality standards and sold to the utilities. Some natural gas that is produced cannot be sold because its natural chemical characteristics do not meet the utility pipeline quality standards. When this "waste gas" is produced, it is generally disposed of either by re-injection back into a geological formation or burning though a permitted flaring process.

Hydrogen sulfide and CO_2 are some of the commonly produced waste gases. Hydrogen sulfide is a flammable, colorless gas that is toxic at extremely low concentrations in air. High concentrations of hydrogen sulfide in drinking water have been known to cause nausea, illness, and in extreme cases, death. Hydrogen sulfide is also extremely corrosive. CO_2, when re-injected into a geological formation, may create risks such as CO_2 leakage, methane leakage, seismicity, ground movement, and displacement of brine.

As stated in the road map, DOGGR's existing statutory authority to permit and regulate the re-injection of the gas component of produced fluids is ambiguous. However, it appears that the agency will move forward with the position that it does have this authority. One of the road map "considerations" for this issue is to determine whether existing staffing levels are sufficient for fluid disposal oversight.

<u>The committee may wish to ask DOGGR if its staffing levels are sufficient for this oversight and whether it has the expertise to regulate waste gas disposal</u>

7) <u>Program Implementation Issues (see issues "6" through "9" in the road map).</u>

The road map includes four program implementation issues: "Worker Safety," "CalWIMS statewide," "E-Reporting," and "Improve Information and Technology Sharing." While these issues do have some important policy relevance, they are mostly administrative and technical in nature. Regulations or legislation are not necessarily needed for improvement or development in these areas. However, the Legislature has recently been engaged on these issues through the budget process. Specifically, for each of the last three years, the Legislature approved budget proposals that will significantly increase staff and improve administration of the program. <u>The committee may wish to ask DOGGR if its staffing levels are currently sufficient to address its program implementation issues.</u>

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[i] El Shaari, N., W.A. Miner. Northern California Gas Sands - Hydraulic Fracture Stimulation Opportunities and http://www.onepetro.org/mslib/app/Preview.do?paperNumber=SPE-114184-MS&societyCode=SPE

[ii] http://www.bakersfieldcalifornian.com/business/oil/x65918320/Monterey-Shale-brightens-Kerns-oil-prospects

[iii] http://www.netl.doe.gov/technologies/oil-gas/publications/eordrawings/BW/bwcyclic_stm.PDF

[iv] Holtzclaw, J.I. and Aubrey G. Branson, Berry Petroleum Co. Automating Continuous Steam Injection in the Diatomite Formation, Midway Sunset Field, California. SPE Western Regional Meeting. March 30 – April 1, 2005, Irvine, CA.

Attachment 1

Oil and Gas Issues Road Map

In the coming months, the Department of Conservation (Department) and the Division of Oil, Gas, and Geothermal Resources (Division) must develop plans to address the following issues. Each will require different levels of resolution, potentially requiring changes in regulation and/or statute. Two categories of issues are identified – Regulatory Issues and Program Implementation Issues.

REGULATORY ISSUES

1. Hydraulic fracturing for well stimulation -- "Fracking"

Hydraulic fracturing for well stimulation (fracking) has been in use in California for many years. Existing Division regulations that protect well casings, hydrocarbon-bearing geologic formation, and groundwater all apply to wells through which fracking was conducted. The Department is beginning a series of workshops to scope regulations that would:

- Specify steps required to ensure well integrity.
- Specify well integrity testing.
- Ensure resource protection.
- Detail reporting requirements.

Following the input received from workshops, in the summer of 2012, the Department intends to release draft regulations for review and comment through the Administrative Procedures Act's Rulemaking Process. In addition, the Department has asked that all operators begin reporting their fracking activities on FracFocus.org, a nationally-recognized clearinghouse, sponsored by the Groundwater Protection Council and the Interstate Oil and Gas Compact Commission (IOGCC). The Department also is seeking to commission an independent study of fracking in California to identify the actual impacts of fracking. This will be vital information in identifying risks to protect public health, safety, and the environment and evaluating how regulations might change to address identified risks.

Considerations:

a) Determine how pending legislation affects the ultimate rulemaking process to ensure that two rounds of regulation do not become necessary.
b) Evaluate how the information provided as a result of reporting on FracFocus.org will help to evaluate in-state fracking operations.
c) Ensure independence of study, as well as timely completion of study to inform the regulatory process.
d) Any appropriate additional limitations for fracking.

2. Underground Injection Control Program

The Division has a Memorandum of Agreement with the U.S. Environmental Protection Agency (US EPA) granting the Division primary regulatory authority over Class II wells in California. The primacy agreement is based on a demonstration that the State UIC Program is compatible with the U.S. Safe Drinking Water Act and that the Division regulates Class II injection wells in a manner that effectively protects underground sources of drinking water. An audit by the US EPA identified deficiencies in the Department's oversight of those wells. The current trend in oil field production is toward increased use of water injection, for enhanced oil recovery and/or for disposal of waters produced with oil and natural gas. The Department must ensure it conducts appropriate reviews consistent with the primacy agreement, and also keeps pace with the trends in oil and gas production.

Considerations:

a) Ensure the Department has sufficient staffing to implement the UIC program in California, a question presently before the Legislature in the form of a BCP in the Governor's FY 2012-13 Budget.
b) Update existing regulations – most of which are more than 30 years old – to identify any changes needed to reflect developments in engineering and production practices.
c) Ensure the Department can address all of the issues raised by the US EPA audit and that it can process all UIC permits expeditiously.

3. Cyclic steam – Shallow Diatomite

The use of cyclic steam in the production of heavy and tight oil resources from diatomite formations has been growing. Division rules and regulations for well construction and operation in cyclic steam conditions should be examined to determine if and how they should be modified to reflect the different conditions and forces exerted on production wells and on the subsurface geology.

Considerations:

a) Draw distinctions and identify similarities between cyclic steam production and underground injection operations.
b) Identify how depth of formation (shallow diatomite vs. deeper formations) impacts the ability of operators to manage safe and efficient production.
c) Identify whether existing well casing requirements/regulations can meet cyclic steam injection/production challenges and, if not, identify changes needed in well construction regulations.

4. Carbon Dioxide Capture and Storage (CCS) vs. Enhanced Oil Recovery (EOR) – When is practice EOR and when is it CCS?

The Department is aware of growing interest in using carbon dioxide (CO2) as an enhanced oil recovery (EOR) tool, in combination with CCS goals. DOC has authority to oversee EOR projects, as reflected in its Underground Injection Control (UIC) Program. That UIC program has been granted primacy to satisfy federal Safe Drinking Water Act requirements for Class II wells. Department expertise in this field is limited because in California water and steam are used far more extensively as EOR injection material than CO2. CO2 does have different properties in a subsurface environment, and the Department needs to make sure that any projects involving CO2 injection receive appropriate review by professionals with competency in subsurface CO2 dynamics. The US EPA considers CCS wells to be Class VI wells, over which the Department has no current authority.

Considerations:

a) Ensure Department has expertise to oversee CO2 injection for EOR.
b) Determine components required for statutory changes if the State should seek US EPA state-level authority for Class VI injection wells / sequestration projects. Consider which agency of CA government most appropriately should have Class VI well primacy from US EPA.

5. Waste Gas

The Department's existing statutory authority to permit and regulate the re-injection of the gas component of produced fluids is ambiguous. Pending legislation (SB 711, Rubio) will clarify the Department's authority over these operations. Consistent implementation of the authority across the Division becomes the next step, and the Department will need to undertake a regulatory development process to implement SB 711 if it becomes law.

Considerations:

a) Evaluate degree to which such gas is associated with produced fluids (usually brine) and practically and safely can be disposed of back into the zone from which it was produced or into other zones.
b) Determine whether the Department permits injection fluid blends that bear little resemblance, in their content, to produced fluids, fluids that typically emerge from California's oil and gas fields.
c) Consider different standards, for different oil and gas fields, given that sour gas (as a subset of "waste gas") is not uniformly present across the State.
d) Determine whether existing staffing levels are sufficient for fluid disposal oversight.

PROGRAM IMPLEMENTATION ISSUES

6. Worker safety

Currently, Division staff receive worker safety training. However, tragic incidents remind the industry and regulators that oil and gas production operations have potential, attendant hazards. Safety trained and appropriately equipped staff is one of the Division's top goals.

Considerations

a) Review the Department's use (and, as needed, supply) of personal protective gear to ensure appropriateness to the working environment.
b) Review Department's safety and injury prevention training requirements to ensure consistency with worker safety rules and with the demands created by the workplace (e.g., oil field operations).

7. CalWIMS statewide

The Department's California Well Information Management System (CalWIMS) has been a work-in-progress for several years. Different district offices had different types of data recorded for wells, but also had common data fields across different districts. The Division needs to finalize this project so that all districts have well information available in a similar method of access, even if the data fields differ somewhat. This system will also provide the platform to pursue E-permitting, E-inspect, and on-line data. The Department's principal concern with this item is ensuring that it remains a high priority through completion and does not get sidelined or unreasonably delayed as new challenges arise.

Considerations

a) Identify and overcome barriers to complete conversion by all six divisional offices and integrate Division headquarters information needs into CalWIMS.
b) Determine whether resolution of district-specific requirements for CalWIMS can/should be developed under contract for IT services or by in-house development staff.

8. E-Reporting

Separate from CalWIMS, E-reporting by oil or natural gas producers could speed review and approval processes. Presently, Notices of Intent are most often submitted on paper form. Allowing E-permitting and reporting could speed report generation, oversight, and oil and gas assessment collections. Further evaluation would also be appropriate in determining how to balance the desire to speed reporting and collections with the cost imposed on operators to comply with E-reporting requirements.

Considerations

a) Determine degree of technology capability across spectrum of reporting oil/gas field operators.

b) Identify efficiencies (speed, cost savings, etc.) that could arise from E-reporting for both the Division and for industry operators/reporters.

9. Improve Information and Technology Sharing

Department mapping and modeling of subsurface geology and oil field operations are largely limited to two-dimensional rendering of well bores, construction, and of oil fields. Many oil operators, though, have the ability to track these two-dimensional details, but to *create three-dimensional models of the subsurface geology*. The Department is charged with regulating to ensure well integrity across ground water zones and hydrocarbon zones. Three-dimensional modeling of subsurface geology would give the Department access to similar information as used by the operators, potentially allowing the Division to anticipate proposals and problems that could arise around new drilling permits, as well as issues that could arise from operational or structural changes to existing wells.

Considerations

a) Evaluate value of added analytical capability relative to oversight of oil and gas drilling, production, and injection operations.
b) Identify required software, hardware, and staff training requirements.
c) Initiate discussion with industry regarding partnerships to fund update of technologies.
d) Initiate discussion with industry about possible sources of data for subsurface geology analysis.

Attachment 2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105-3901

July 18, 2011

Elena Miller
State Oil and Gas Supervisor
Department of Conservation
Division of Oil, Gas and Geothermal Resources
801 K Street, MS 20-20
Sacramento, CA 95814-3530

Dear Ms. Miller:

I am pleased to transmit to you a copy of the California Class II Underground Injection Control (UIC) Program Review final report (Final Report) dated June 2011 and EPA's findings and recommendations. As you know, EPA utilized a contract with the Horsley Witten Group to conduct an evaluation of California's implementation of the Class II UIC primacy program. The goals of this program evaluation were to review how the California Division of Oil, Gas, and Geothermal Resources (DOGGR) oversees and manages the permitting, drilling, operation, maintenance and plugging/abandonment of Class II UIC wells in the State, and identify program implementation recommendations. The Final Report incorporates additional material that was provided to EPA in early June 2011 from your staff.

EPA supports the recommendations that are listed in Section 5.0 Recommendations in the Final Report. I anticipate that some of the recommendations may require state regulatory revisions and others can be addressed through procedural clarifications and modifications. In particular, I want to highlight the following program deficiencies that require more immediate attention and resolution:

- **Federal Definition and Protection of Underground Source of Drinking Water (USDW):** DOGGR UIC regulations and primacy documents do not clearly require the District Offices to protect USDWs to the federally-defined standard of 10,000 mg/L total dissolved solids (TDS) in the permitting, construction, operation, and abandonment of Class II injection wells. Protection of potential drinking water sources which fall between TDS levels of 3,500 mg/L – the level recognized by the State's regulations as "fresh water" – and 10,000 mg/L is essential for DOGGR to demonstrate as a federal UIC primacy agency.

- **Zone of Endangering Influence (ZEI) and Area of Review (AOR):** EPA's review found that ZEI determinations are not being performed for injection wells throughout the state and AOR analyses are based almost exclusively on a fixed quarter-mile radius approach. Whereas the fixed radius approach may be appropriate for some injection wells, there are others where this approach will not adequately capture the full extent of pressure influences from the injection activity (i.e., the ZEI, if calculated, would exceed a quarter-mile radius around the well) and will require an expanded AOR.

- **Step Rate Tests/Maximum Allowable Surface Pressure:** Both California and federal UIC regulations mandate that maximum surface injection pressure must be lower than the fracture pressure of the injection zone. However, EPA's review found that for most Class II injection wells and well fields overseen by DOGGR, the fracture pressure of the injection zone is determined by an estimate of the formation fracture gradient, rather than from a well or field/formation-specific step-rate test (SRT) that would yield a more accurate measurement of fracture pressure. Moreover, even in instances where a SRT was performed, DOGGR allowed operators to use only surface pressure measurements, rather than the more accurate combination of surface and bottom-hole measurement.

Additionally, the final report includes recommendations for DOGGR to ensure that the State's Class II UIC program meets all federal requirements. These recommendations request clarification, improved procedures, and consistent standardized implementation pertaining to several areas including UIC Staff Qualifications; Annual Project Reviews; Mechanical Integrity Surveys and Testing; Inspections and Compliance/Enforcement Practices and Tools; Idle Well Planning and Testing Program; Financial Responsibility Requirements; and, Plugging and Abandonment Requirements.

We request that you provide EPA with an action plan (Plan) that addresses the above noted deficiencies and other areas for improvement identified in the Final Report - Section 5.0 - Recommendations by September 1, 2011.

As part of the Horsley Witten Group's research and collection of materials to conduct the program evaluation, your staff provided an agency memorandum entitled Underground Injection Control (UIC) Program Expectations (Expectations Memo), signed by you and dated May 20, 2010. This memo addresses some of the program deficiencies discussed in EPA's Final Report and noted in Section 5.0 - Recommendations. Please include in the Plan a discussion of the Expectations Memo and the status of this document in relation to the EPA-approved DOGGR Class II UIC Program.

Additionally, after review of the Final Report my staff realized that a discussion of DOGGR's permitting and oversight procedures for Class II slurry-fracture injection was not included in the questionnaire which the Horsley Witten Group used to collect information for this program review, due to EPA's error. As we are still interested in this topic, my staff plans to reach out to each of the District Offices to learn more about Class II applications of slurry-fracture injection in California. Also, we are interested in following up with the appropriate District Offices on any outstanding material which the Final Report identifies, including the limited use of compressed bentonite for plugging and abandonment procedures in District 4.

We look forward to any feedback you have on the Final Report and the submittal of your Plan to address the recommendations for program improvement. Once again, I wish to extend my sincere thanks to you and your staff for supporting this effort, and for the cooperation and resources all six District Offices provided to the Horsley Witten Group in responding to the Questionnaires, hosting site visits, and conducting follow-up as requested.

Sincerely,

David Albright, Manager
Ground Water Office

Enclosure

cc: Rob Habel, Deputy Oil and Gas Supervisor
District Deputies, Districts 1-6

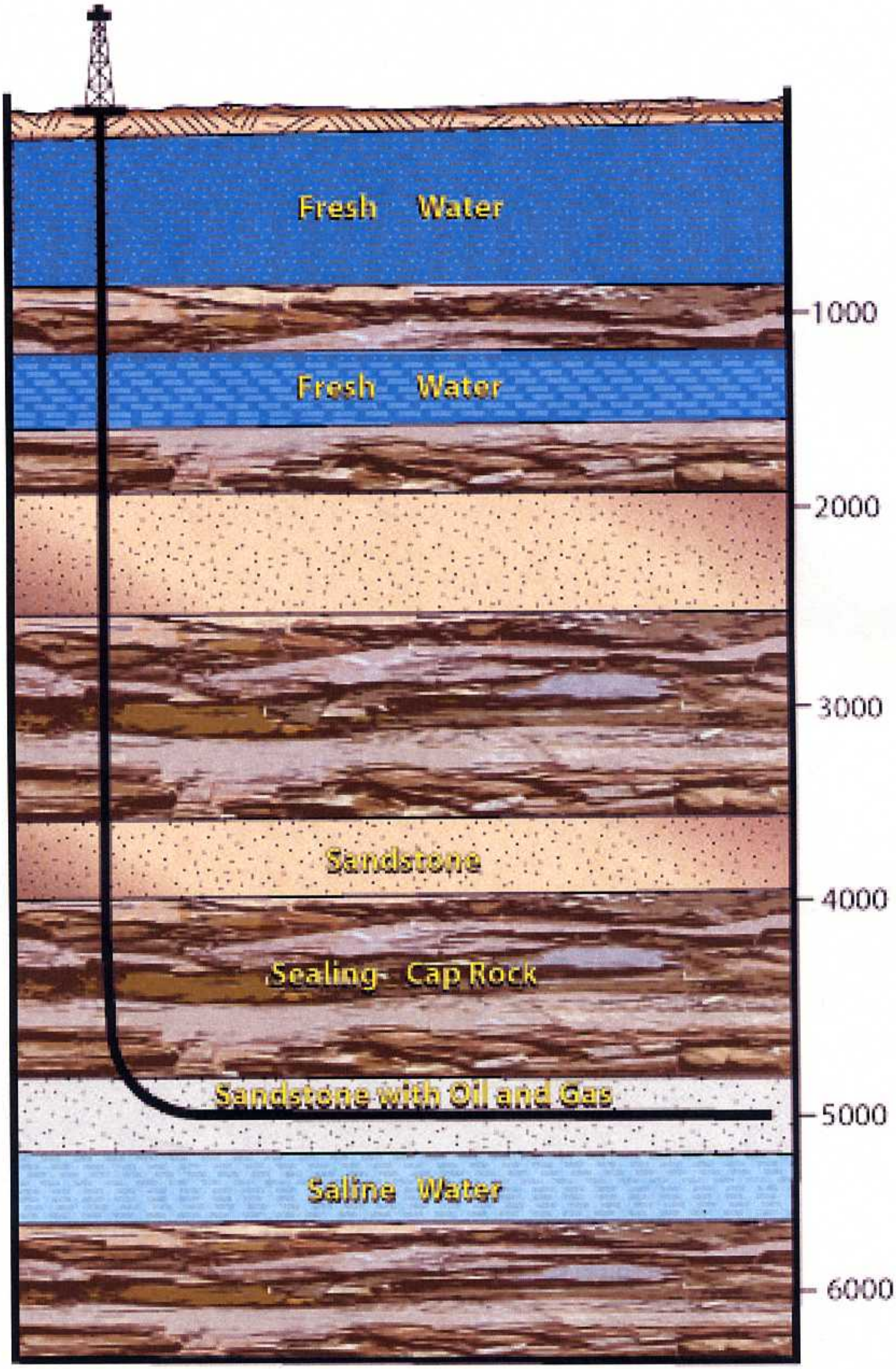
Attachment 3

HYDRAULIC FRACTURING IN CALIFORNIA

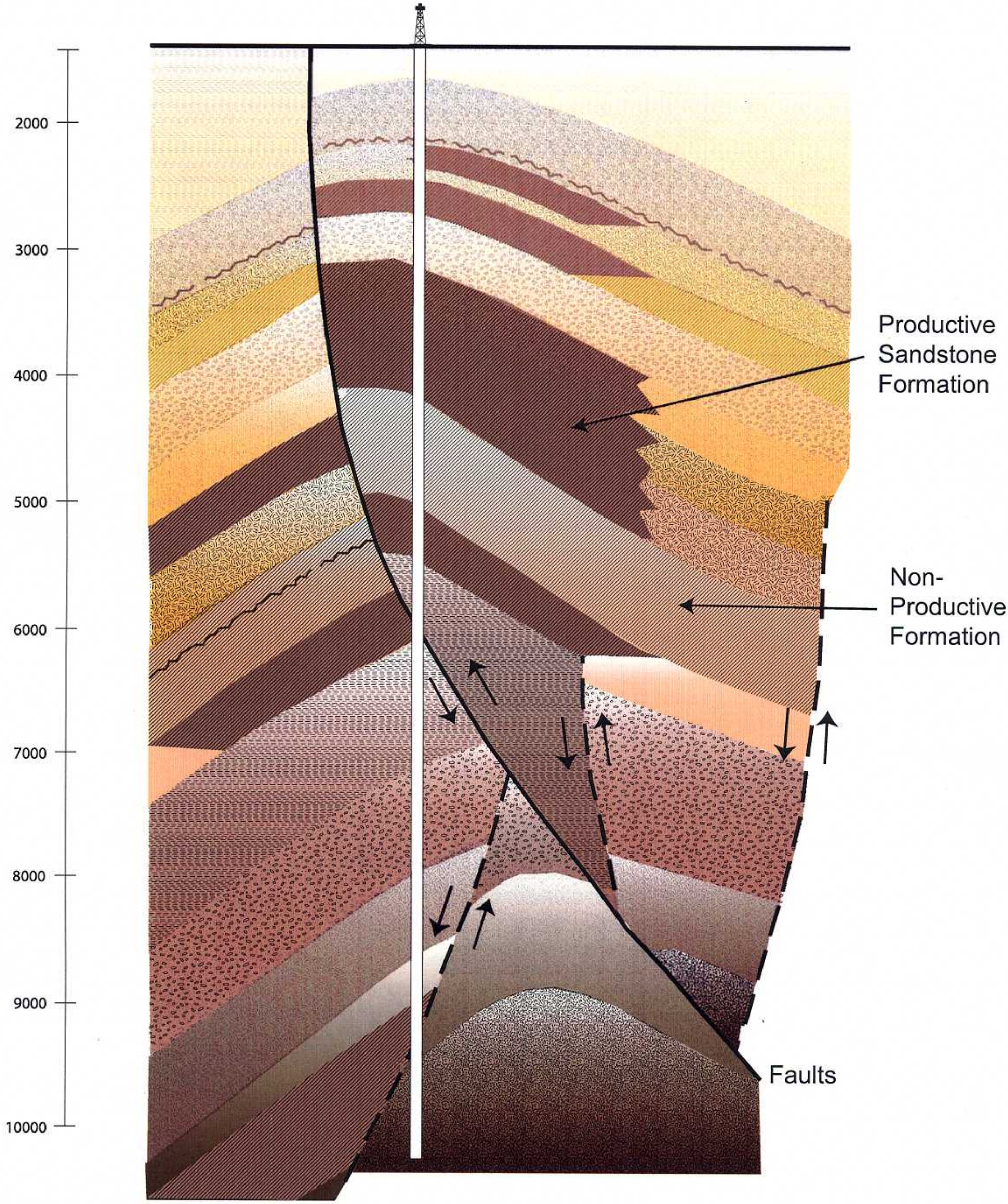
CALIFORNIA DEPARTMENT OF CONSERVATION
DIVISION OF OIL, GAS, AND GEOTHERMAL RESOURCES

comments@conservation.ca.gov

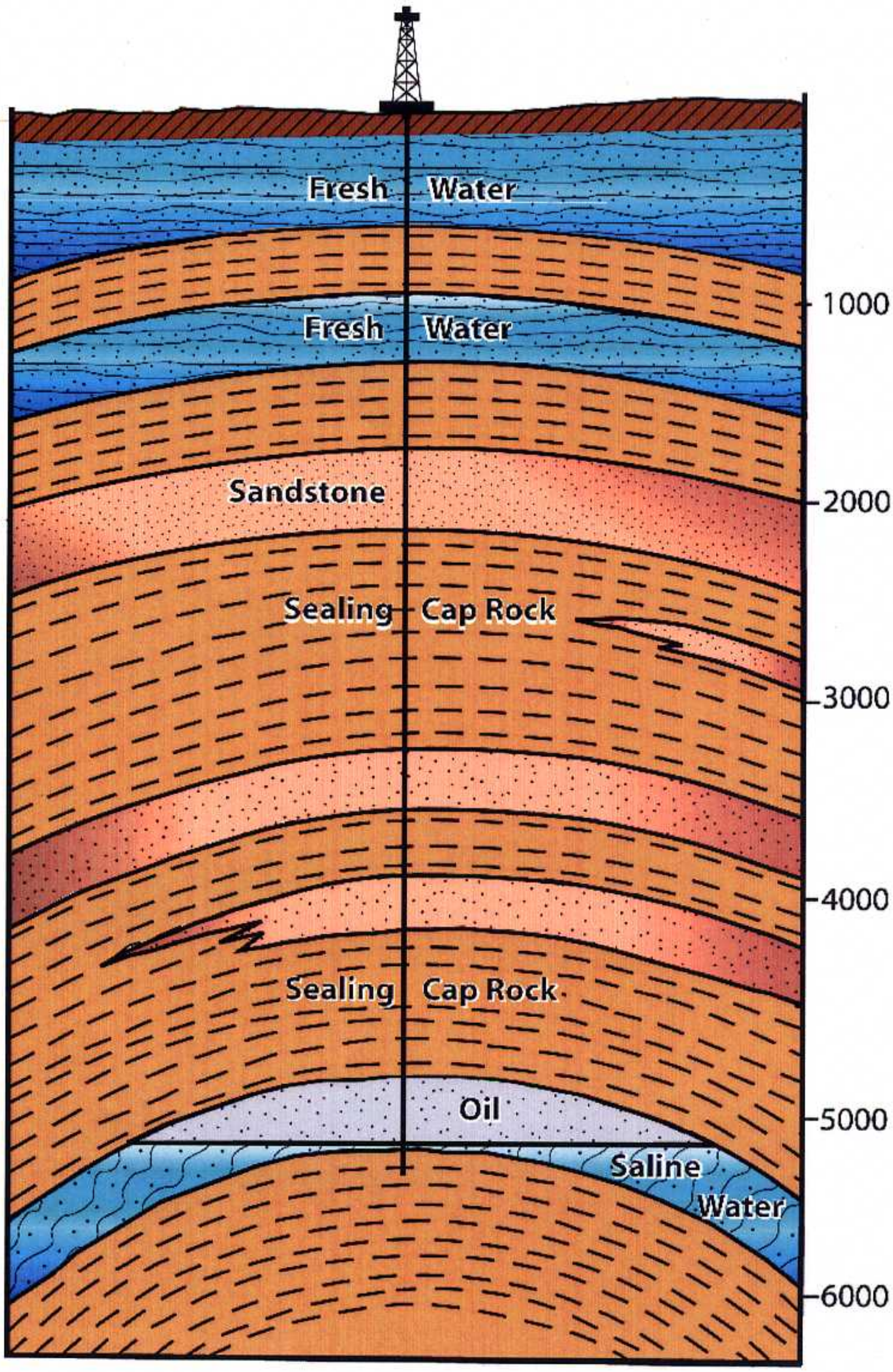
Horizontal Well Completion



Oil Field Cross Section

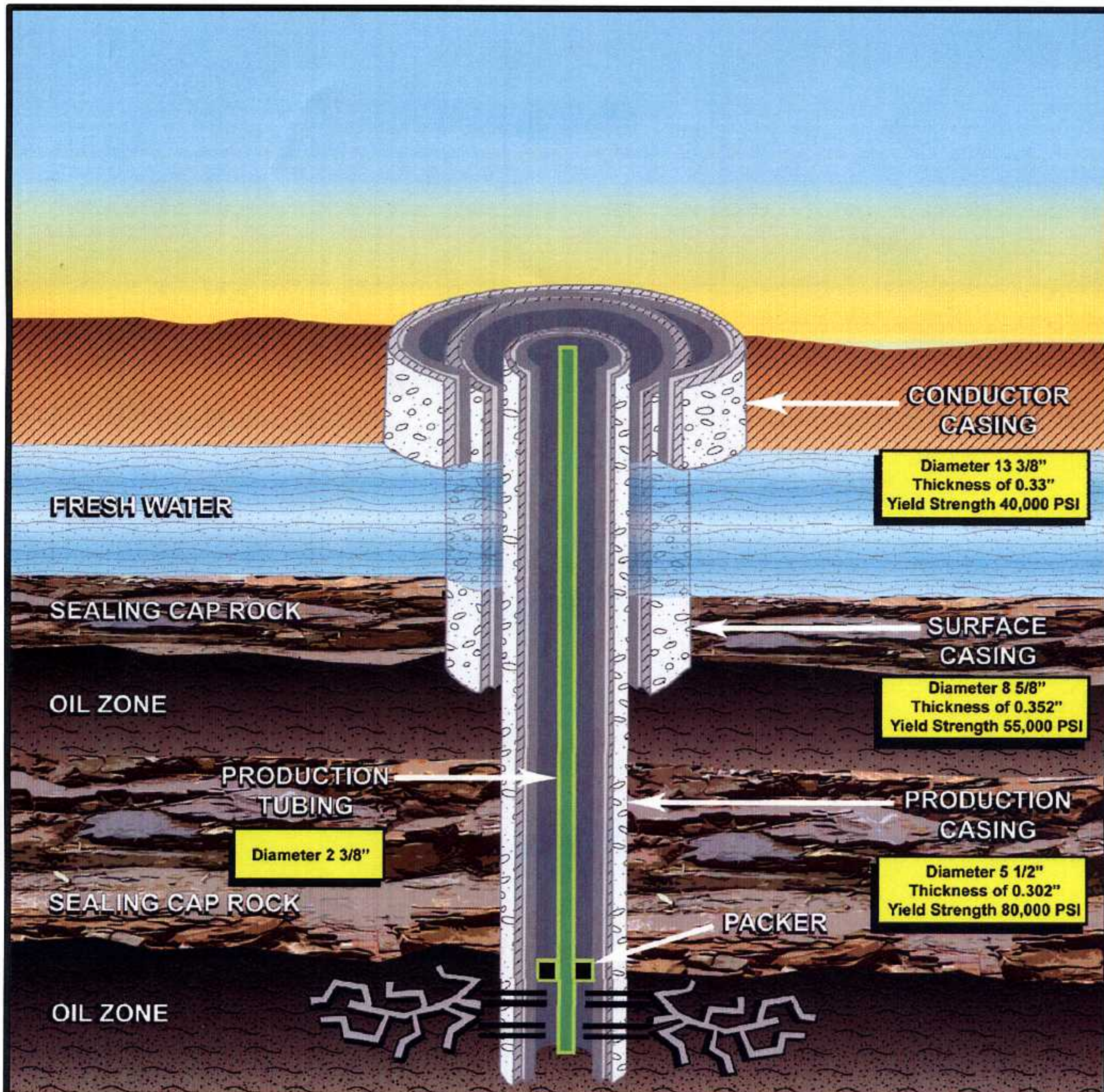


Simplified Geology of Conventional Oil and Gas

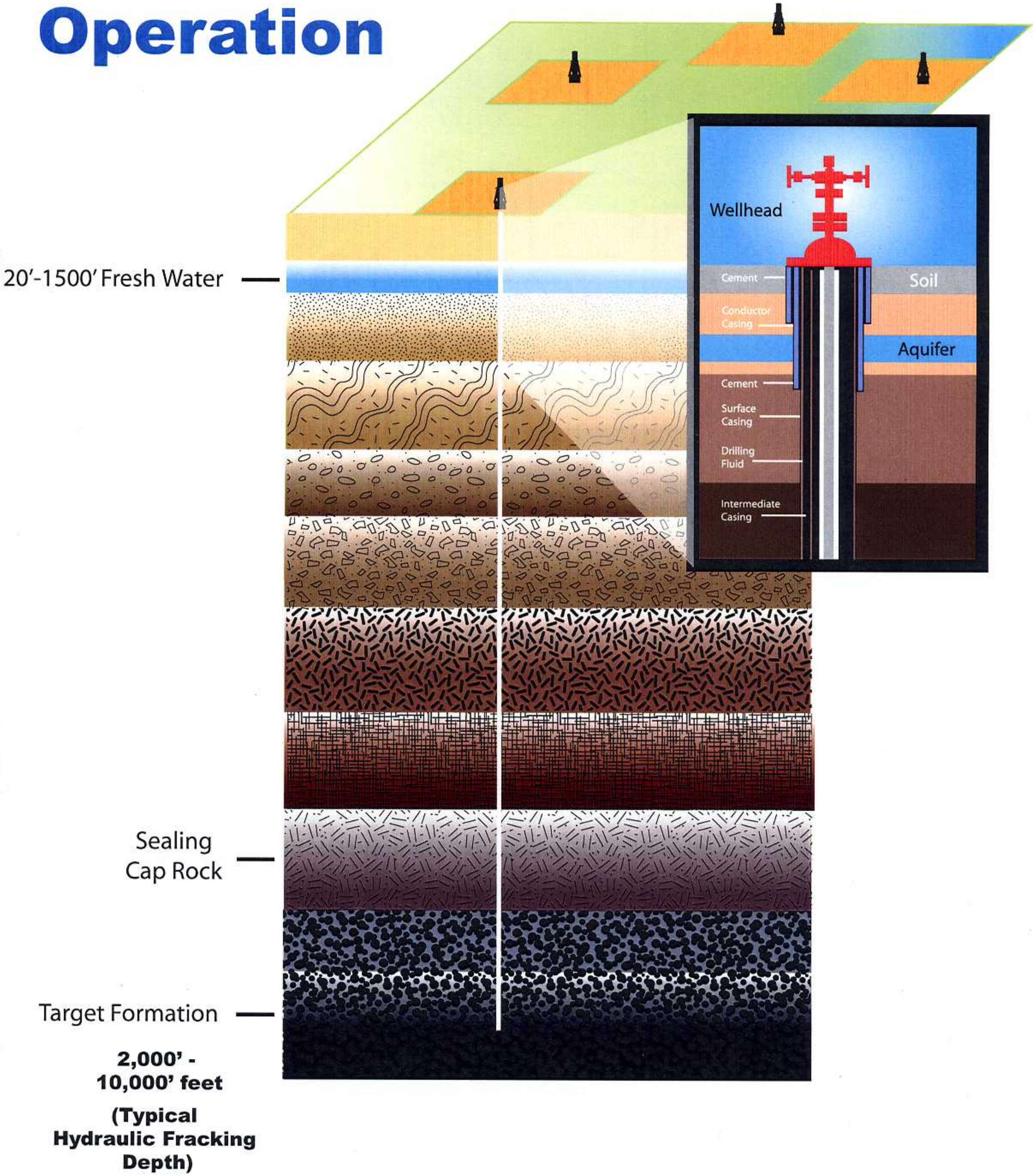


Typical Well Casing

(NOT TO SCALE)



Typical Hydraulic Fracturing Operation



Sample FracFocus Report
fracfocus.org

Hydraulic Fracturing Fluid Product Component Information Disclosure

Last Fracture Date:	03/20/2012
State:	California
County:	Kern
API Number:	04-030-46719
Operator Name:	Vintage Prod Of Cal
Well Name and Number:	Ware & Hauser 15-23W
Longitude:	-119.68485
Latitude:	35.39697
Long/Lat Projection:	NAD83
Production Type:	Oil
True Vertical Depth (TVD):	7,000
Total Water Volume (gal)*:	339,654

Hydraulic Fracturing Fluid Composition:

Trade Name	Supplier	Purpose	Ingredients	Chemical Abstract Service Number (CAS #)	Maximum Ingredient Concentration in Additive (% by mass)**	Maximum Ingredient Concentration in HF Fluid (% by mass)**	Comments
Water	Operator	Carrier	Water	7732-18-5	100.00%	87.75632%	
Alpha 125, 263 gl tote	Baker Hughes	Biocide	Glutaraldehyde	111-30-8	30.00%	0.00450%	SmartCare Product
GBW-5	Baker Hughes	Breaker	Ammonium Persulfate	7727-54-0	100.00%	0.00279%	SmartCare Product
Enzyme G-I	Baker Hughes	Breaker	Hemicellulase Enzyme Concentrate	9025-56-3	3.00%	0.00119%	SmartCare Product
			Water	7732-18-5	97.00%	0.03834%	
High Perm CRB	Baker Hughes	Breaker	Ammonium Persulphate	7727-54-0	60.00%	0.00186%	SmartCare Product
			Crystalline Silica Quartz	14808-60-7	30.00%	0.00093%	
BC-3	Baker Hughes	Breaker Catalyst	No Hazardous Ingredients	Trade Secret	100.00%	0.01318%	
BF-7L, Tote	Baker Hughes	Buffer	Potassium Carbonate	584-08-7	60.00%	0.03290%	SmartCare Product
			Potassium Hydroxide	1310-58-3	1.00%	0.00055%	
			Water	7732-18-5	60.00%	0.03290%	
BF-7L	Baker Hughes	Buffer	Potassium Carbonate	584-08-7	60.00%	0.01575%	SmartCare Product
			Potassium Hydroxide	1310-58-3	1.00%	0.00026%	
			Water	7732-18-5	60.00%	0.01575%	
Clay Master-5C (Tote)	Baker Hughes	Clay Control	Oxyakylated Amine Quat	138879-94-4	60.00%	0.06237%	
FRW-18	Baker Hughes	Friction Reducer	Petroleum Distillates	64742-47-8	30.00%	0.00764%	SmartCare Product
GW-3LDF	Baker Hughes	Gelling Agent	Acyclic Hydrocarbon Blend	Trade Secret	60.00%	0.18736%	SmartCare Product
			Alcohols, C12-14, Ethoxylated Propoxylated	68439-51-0	5.00%	0.01561%	
			Crystalline Silica, Quartz	14808-60-7	5.00%	0.01561%	
			Guar Gum	9000-30-0	60.00%	0.18736%	
Sand, White, 40/70	Baker Hughes	Proppant	Crystalline Silica (Quartz)	14808-60-7	100.00%	0.99471%	
Sand, White, 100 mesh	Baker Hughes	Proppant	Crystalline Silica (Quartz)	14808-60-7	100.00%	0.89865%	
Super LC, 30/50	Baker Hughes	Proppant	Hexamethylenetetramine	1009-7-0	0.01%	0.00092%	
			P/F Resin	9003-35-4	5.00%	0.45843%	
			Silicon Dioxide (Silica Sand)	14808-60-7	97.00%	8.89360%	
GasFlo G, 330 gal tote	Baker Hughes	Surfactant	Methanol	67-56-1	30.00%	0.05341%	SmartCare Product
			Mixture of Surfactants	Trade Secret	60.00%	0.10682%	
			Water	7732-18-5	50.00%	0.08901%	
Ingredients shown above are subject to 29 CFR 1910.1200(i) and appear on Material Safety Data Sheets (MSDS). Ingredients shown below are Non-MSDS.							
			Acetyl Triethyl Citrate	77-89-4		0.01317775449%	
			Cured Acrylic Resin	Trade Secret		0.0009296328%	
			Ethoxylated Alcohol	Trade Secret		0.00050937788%	
			Isotridecanol, Ethoxylated (TDA-6)	9043-30-5		0.0156135082%	
			Isotridecanol, Ethoxylated (TDA-9)	9043-30-5		0.0156135082%	
			Methanol	67-56-1		0.0000375153%	
			Poly (acrylamide-co-acrylic acid)	Trade Secret		0.0076406827%	
			Quaternary Ammonium Compounds bis[Hydrogenated Tallow Alkyl] Dimethyl Salts With Bentonite	68953-58-2		0.0156135082%	
			Salt	Trade Secret		0.0012734471%	
			Sorbitan Monooleate	Trade Secret		0.0012734471%	
			Water	7732-18-5		0.0396025696%	

* Total Water Volume sources may include fresh water, produced water, and/or recycled water

** Information is based on the maximum potential for concentration and thus the total may be over 100%

Ingredient information for chemicals subject to 29 CFR 1910.1200(i) and Appendix D are obtained from suppliers Material Safety Data Sheets (MSDS)

Attachment 4

BakersfieldNow.com - KBAK and KBFX News
Bakersfield, California

Print this article

Fatal sinkhole accident brings new state regulations

Originally printed at http://www.bakersfieldnow.com/news/local/152403665.html

By Carol Ferguson, KBAK - KBFX - Eyewitness News - BakersfieldNow.com May 21, 2012

BAKERSFIELD, Calif. (KBAK/KBFX) — State regulators say they need more information to pinpoint what caused a sinkhole where a Chevron worker died near Taft, but they promise new regulations aimed at preventing situations like that.

It was almost one year ago when 54-year-old Robert David Taylor fell to his death. The sinkhole had opened up near Chevron Well No. 20 on the morning of June 21, 2011.

"It's apparent that the steaming leads - can lead - to that type of event," said state spokesman Tim Kustic in a conference call from Sacramento on Monday. Kustic is the state oil and gas supervisor for the Division of Oil, Gas and Geothermal Resources, or DOGGR.

Steam has been used in oil fields to help get oil out of the ground. The DOGGR report dated May 2 notes fluid had been seen on the ground in the Midway-Sunset oil field since the late 1990s. "Surface expression" is the term they use, and they noted it near the accident site for several years.

"Surface expression activity at the Well 20 surface expression area began in 2006," the report says.

New photos show what looks like steam coming from Well 20, and a fluid pit and crater in October, 2010. It states the later accident happened in that area or to the left of the crater. The report says the location was "continually active with surfacing water, oil, and steam."

On Monday, the DOGGR spokesman said they plan to put new rules in place dealing with operations in areas like this.

"We see the need to, at this point in time, clearly move forward with a regulatory package for this unique resource," Kustic said. Unique, in that the sinkhole happened in what regulators call a shallow formation of "diatomite reservoir."

Regulators said "surface expressions" can often be fluid seeping to the ground. But, they hope the new regulations will address concerns, potential dangers, and a "gap" in current state rules.

"We know we need to, at the greatest extent possible, eliminate or curtail surface expressions," Kustic said. "As far as what the regulations are going to look like, we aren't through identifying what they're going to look like."

He said current rules prohibit spills of oil on the ground, the new regulations could include reporting surface expressions.

The exact cause of the sinkhole last June still isn't known.

"That's the on-going investigation," Kustic said. "We don't have a cause or causes at this point in time," He said DOGGR needs more information from Chevron, and a company operating a nearby well, TRC.

He described the investigation as being done in three phases, and called the current status the early part of phase two. Some new information is included in latest DOGGR report on conditions leading up to the fatal accident.

The report says while surface expression activity started near Well 20 in 2006, last year on June 21, Chevron workers had noticed a release of steam from "a known and previously open surface expression location."

"Three men were checking steam emanating from the ground," the report quotes a Chevron spokesman. "Ground gave way, one worker slipped feet first into a hole. Other workers could not react in time to save him from falling."

They were in an area where Chevron was working to deal with fluids getting to the ground.

"In an attempt to control steam and fluids from reaching the surface, in the early months of 2011 Chevron reportedly began construction of a subsurface containment structure at the Well 20 surface expression site," the report says. DOGGR officials say that work was finished in April or May that year.

On Monday, the DOGGR spokesman told Eyewitness News they don't know how many underground containers may have been used in oil fields.

After the accident, there were more surface expressions, and DOGGR says "thermal activity" increased significantly with steam, water and oil coming up from an enlarging crater. Two large eruptions of steam, water, oil and rocks happened in August, according to state officials.

The DOGGR report says the underground containment structure is still in place, probably 20 to 30 feet down, and its condition is unknown.

In the summer of 2011, a series of orders went out to Chevron and TRC restricting steam injection in wider and wider areas around Well 20, and the nearby TRC facility, the "Bull 9" well.

Last summer, DOGGR asked for information on readings from "tilt meters" in the affected area. That equipment monitors ground movement. State regulators asked for data on four time periods in June.

DOGGR lists six questions they currently have for Chevron and TRC. They want to know more about data from the tilt meters, and work on the underground structure at Well 20.

"Did Chevron have any safety concerns regarding the area after completion of the subsurface containment structure and terrace re-construction," reads one question.

"What communication regarding steam injection cycles, steam volumes and interpretation of tilt meter events existed between Chevron and TRC prior to the June 21 accident," reads another question. Kustic said the questions in the report haven't been discussed with the companies yet, they're providing this information to them now.

Chevron responded to Eyewitness News with an email statement.

"Chevron has worked responsibly and been open and transparent with DOGGR. We have responded to all of their questions, and provided all the information they have asked for as we've worked through this event," it reads. A spokesman said that is response to the questions in the latest DOGGR report.

Chevron also responds to the issue of the fatal accident. "This was a tragic event that has saddened the people who work here. We place high value on safety of our employees and contractors who work with us, and we are working hard to understand exactly what happened and to prevent it from happening again."

A spokesman for TRC said they are also cooperating fully with DOGGR. Larry Pickett told Eyewitness News TRC has done all the well testing they've been asked to do in the area.

"We are working with an industry group and DOGGR on production procedures and safety measures," Pickett said.

The state report suggests several issues are being researched, such as well-casing or bore damage. That's still underway.

"That's why the investigation continues, to figure out the impact of damaged well bores through the whole process that's going on out there," Kustic told Eyewitness News. "That's part of the whole investigation, and hopefully that will be answered."

Asked about safety and conditions in that oil field now, the state spokesman said "surface expressions" have been seen seen, but a sinkhole just opening up, and the conditions at that time were unique.

"It's relatively rare, based on years of practice," Kustic said. "Could it happen again? It has that potential."

But, the new regulations are planned, though Kustic couldn't say when that will happen.

"This is a learning event, and to the greatest possibility, we want to take the information learned from this investigation forward for our regulation purposes," Kustic said. "And hopefully, share with our operators so we can avoid these kinds of tragic accidents in the future."